FIRE DEPARTMENT STAFFING STUDY FOR THE TOWN OF AMHERST, MASSACHUSETTS

September 28, 2017

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September 28, 2017

Mr. Paul Bockelman
Town Manager
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4 Boltwood Ave.
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Mr. Bockelman,

The Carlson Group is pleased to present the Staffing Study of the Fire Department for the Town of Amherst. It has been a true pleasure to work with you, the Fire Chief and his team, and staff of the Town during this process. The Town of Amherst is a beautiful community, and you are all fortunate to live and work there!

The Town of Amherst is evolving in a number of ways that are impacting the Fire Department, and that are impacting the delivery of "all hazards", i.e.: fire, emergency medical (EMS), hazardous materials response, and also technical rescue services in the community and in several neighboring communities. Growth in call volume has continued at a steady pace over the years – both within Amherst and in communities for which you provide EMS services under contract. Adapting to these changes, and findings ways to continue to provide exceptional services with rapid response times will need to be a major focus of the Fire Department, the Select Board, and the Town for years to come.

This document identifies the steps that the Town, and the Fire Department should consider undertaking to address the impacts of growth and change on fire / rescue services in the Town. This report identifies steps that are necessary in staffing, contracts, and new approaches to delivering services. A combination of these approaches will provide the Town not only with the benefits of continuing and improving services, but also with a fiscally responsible solution.

If you have any questions, please do not hesitate to contact Travis Miller via email: travis@carlsonmed.com.

Sincere Regards,

The Carlson Group

The Town of Amherst retained the Carlson Group, a national public safety management consulting firm, to conduct an evaluation of the staffing for the delivery of fire and emergency medical services in the Town, and to make recommendations for addressing any necessary changes. This analysis is primarily focused on the following issues:

- What is the appropriate level of on-duty staffing for the Fire Department given current and expected workloads.
- What should be done with regards to the on-call and student volunteer forces which currently serve to augment responses?

The Staffing Study for the Fire Department was developed through the work of an outside consultant from the Carlson Group. Data and other support to the consultant was provided by staff from the Fire Department and the Town Manager and other Town staff.

1. Methodology

The Carlson Group was retained by the Town of Amherst to evaluate several key issues related to staffing requirements for the delivery of fire and emergency medical services in the Town, and in the four towns which comprise the contractual EMS service delivery area. The Fire Department and indeed the community as a whole have undergone several significant changes in recent years – including changes which have, in Amherst, slowly reduced the availability of paid-on-call forces, and increasing the reliance on paid career force personnel – particularly as the focus on EMS service delivery continues to increase in scope and measure. [1]

In the development of this assignment, the consulting team:

- Conducted interviews with more than 20 people;
- Collected descriptive data regarding calls for service, deployment, finances;

[1] Several studies indicate that the number of volunteer firefighters have been declining nationally. The National Fire Protection Agency has indicated that while there are still almost twice as many volunteers nationwide compared to career firefighters, there has been a 50% increase in the number of paid positions, with a corresponding 15% decline in volunteer / paid-on-call positions. This study attributes this to several root causes: more than 50% time spent on fund raising; increasing focus on EMS rather than less frequent fires; significant increases in training requirements; aging populations especially in less urban communities; and the rise of two-income families reducing the time available to volunteer. Illustratively, working fires now make up only 5% of calls for service, while EMS calls have increased nationally in the fire service by more than 170% since the mid-1980's.

- Held a one-day focus group [2] and follow-up small group interviews in fire stations [3];
- Met informally with staff on multiple shifts in-station;
- Considered a wide range of potential solutions once issues were identified;
- Met with stakeholders to review issues, potential solutions, recommendations, etc.

2. Current Situation

The Carlson Group reviewed the Town's request for proposals, and note that the Town has indicated the following reasons for conducting the study, including: [4]

- Provide fact-based, data-driven analyses that promote enhanced safety, efficiency, and effectiveness of service delivery by the Amherst Fire Department;
- Consider long term roles for Call Force and Student Force;
- Need to evaluate how seasonal as well as academic calendar issues impact workload and staffing needs;
- Evaluate need for all ALS or partial-ALS staffing for EMS responses;
- Efforts by the Fire Chief over the past several years to increase staffing in the Fire Department – both to balance the shifts, and to provide for effective responses to medical and other emergencies.

The Amherst Fire Department is currently deployed from two fire stations, with an active process in place considering the relocation of one of the stations to improve Town-wide coverage. The Fire Department relies on full-time, paid-on-call, and student volunteer fire fighters. The Fire Department provides a range of responses to hazards including:

- Fire prevention, plan review, inspections;
- Fire suppression;
- First response to medical calls, including transport of patients who require treatment in a local hospital;
- First response to technical rescue;
- First response to hazardous materials incidents.

Many of these services are provided on a regional basis, either under contract or as part of the Town's mutual aid response. In order to provide these services, the Fire Department deploys personnel to respond to calls for service in the community.

[2] The focus group included representatives from town management, finance, fire department command, and fire department collective bargaining unit.

[3] These interviews were conducted by one member of our project team on the day of the focus group and on the following day.

[4] These are paraphrased and summarized from the Towns original request for proposals.

The mission of the Amherst Fire Department is:

> "*To enhance the quality of life in our community by providing quality emergency and support services. Through the professionalism, pride, and excellence of our personnel, we will be the leaders in All Hazards preparation, response, and recovery. We will settle for nothing less than outstanding service as we conduct fire suppression, rescue and emergency medical services, fire prevention, safety education, hazardous materials incident response and disaster operations.*"

The Amherst Fire Department provides comprehensive fire, rescue, EMS, and fire prevention services to the Town of Amherst, including the University of Massachusetts (14,300 living on campus), Amherst College (1,800), and Hampshire College (1,400), as well as providing EMS services to the neighboring communities of Hadley (4,793), Pelham (1,321), Leverett (1,876), and Shutesbury (1,800).

The Amherst Fire Department is comprised 46 full time uniformed personnel: a (1) Fire Chief; two (2) Assistant Fire Chiefs (Operations/Training & EMS/Prevention); Eight (8) Captains one (1) Fire Fighter who is the Fire Inspector: and thirty-four (34) line firefighters. All career personnel are, at minimum, EMTs, with 35 additionally licenses as paramedics. There is one (1) Administrative Assistant. [5]

There are four (4) work groups of line personnel (Captains and Firefighters) working on 24-hour shifts – which average out to 42-hours per week. They work one day on: one day off: one day on and five days off from 7 AM – 7AM. It should be noted that prior to January 1, 2012, Fire Fighters and Captains worked two 10 hour days and two 14 hour nights followed by four days off. The workload handled by the Department are summarized, in detail, in a subsequent section of the report.

There is a minimum staffing 'policy' of eight (8) per shift during the university academic year, supplemented to 13 on Friday and Saturday nights from 9 PM through 7AM on approximately 14 weekends (this may vary slightly depending on the academic calendar). During intersession and summer break the staffing minimum is seven (7) personnel. The assigned shift staffing is: two Captains per shift. Two shifts have nine firefighters in addition to the Captains. Two shifts have

[5] The Town of Amherst has 46 full time firefighters with a population of 38,000 and another 28,000 in the colleges. This results in a ratio of 0.7 / 1,000 population during the school year. This puts the AFD on the lower end of similarly sized communities according to the 2017 NFPA publication "U.S. Fire Department Profile – 2015." However, when the Call Force and Student Force are included in the calculation, the number is above the Medan of 1.30 FF / 1,000 population. It should also be noted that the University staffs student EMT units for events (480 + events per year) as well as staffing to handle inspections, alarms, etc. while relying on the AFD to provide EMS transport and fire fighting.

10 firefighters in addition to the Captains. Each shift is divided between the Amherst Center and North Amherst fire stations. [6] The Firefighter-Inspector, the 2 Assistant Chief, and the Fire Chief do not count in the minimum staffing philosophy (though they will respond to calls when needed).

In addition to the Career Force, the Town maintains a Call Firefighter Force with an authorized complement of 24 part-time employees. Call Force members are required to attend paid weekly training and participate in a minimum number of paid drills and responses. Call Firefighters are trained by Career Force members. Call Force personnel play a number of roles in the current operational approach in Amherst:

- When on-duty career personnel are close to being depleted (or have been, due to calls) and off-duty personnel are called back but are unavailable, Call Force personnel are called in to cover the station and to respond to calls.
- Staff public service details and community events.
- Provide a 2-person plow crew during major storms.
- They were called in 115 times during FY16 – this is for calls and for station coverge.
- Staff the ladder truck and additional engine at all reported structure fires.

In addition to the career force and the call force, there are approximately 30 members of a student (trained volunteers) firefighting force who train and work out of the North Amherst Fire Station. Student Fire Fighters may act as Call Force members during school breaks and are also trained by career force members. [7] As with the Call Force, the Student Force members play a number of roles, including:

- Staffing an engine company during the academic years from 6PM to 7AM, and then from 6PM Friday through 7 AM Monday morning. This unit is required to stay within the Town of Amherst, and serves as a key 'relief valve' on call back of off-duty personnel and of Call Force personnel.
- Staff public service details and community events.
- They provided coverage 71 times – meaning that no off-duty or Call Force personnel were called because they were present.
- Staff their engine and a support vehicle, supporting the incident commander with accountability at all reported structure fires.

The Department operates out of two fire stations. Headquarters is at 68 North Pleasant Street, in the heart of downtown Amherst. It houses a front-line engine, a heavy rescue vehicle, a reserve

[6] While there is no "official" written policy that summarizes these minimum staffing levels, they are adopted by the Chief, and implemented by the command staff. These staffing levels are based on the budget available to the Department, and are intended to maximize the AFD's response capabilities within the constraints under which they are currently operating budgetarily and staffing-wise.

[7] Call firefighters and student firefighters training is provided by career firefighters working on scheduled overtime.

engine and two ambulances. Administration also functions from this station, with the Fire Chief, Assistant Chief (EMS/Prevention), the Fire Inspector, and the Administrative Assistant.

The North Amherst station is located adjacent to the UMASS campus at approximately one and a half miles North of Amherst Center. It houses a front-line engine, a second engine operated by the Student Force, a third engine operated by the Call Force [8], a ladder truck and three ambulances. The Assistant Chief (Operations/Training) is based in the North Amherst station.

The Town of Amherst is a member of the Commonwealth of Massachusetts mutual aid plan, has five members on the Western MA Regional Technical Rescue Team and five members on the Commonwealth's Regional Hazmat Team. The only codified service level expectation is in the Town of Amherst's Service Zone Agreement with the State of Massachusetts OEMS. [9]

3. Workload Summary and Analysis

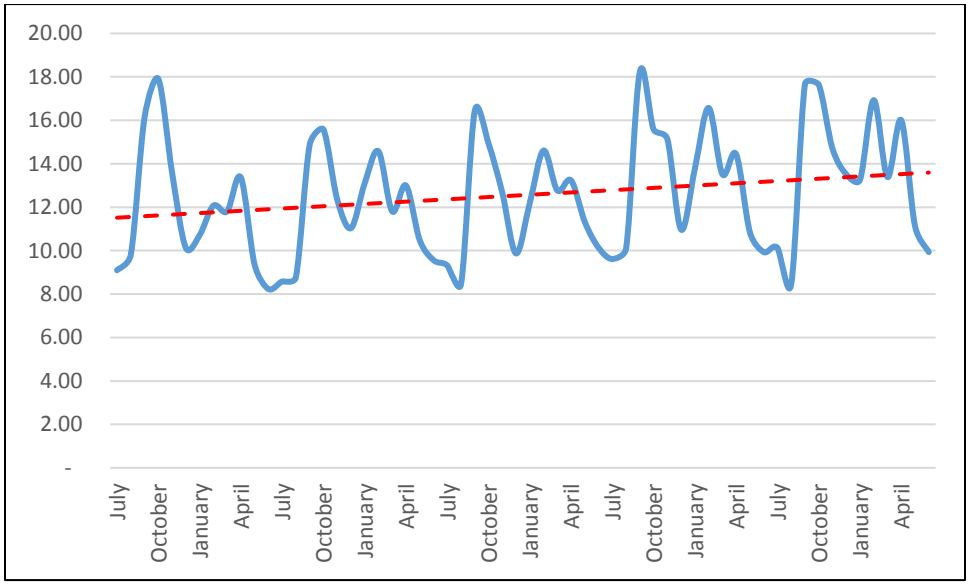
The Carlson Group examined the workload being handled by the Town of Amherst Fire Department over the past five years. In some cases, data were available in calendar years, and in other cases data were available in fiscal years. Where possible, we have adjusted them to make data sets comparable.

[8] The engines operated by the Student Force and the Call Force are acquired and maintained by the Town of Amherst.

[9] The Massachusetts OEMS is the Office of Emergency Medical Services, a state agency whose mission is "to promote a statewide community-based emergency medical services (EMS) system that reduces premature death and disability from acute illness and injury through the coordination of local and regional EMS resources."

The next exhibit shows the average calls per day handled inside the Town of Amherst (Figure 1). This shows a more significant pattern of growth than do the calls handled outside the Town.

Figure 1: Average AFD Calls Per Day / FY12-FY16 Calls Inside Amherst

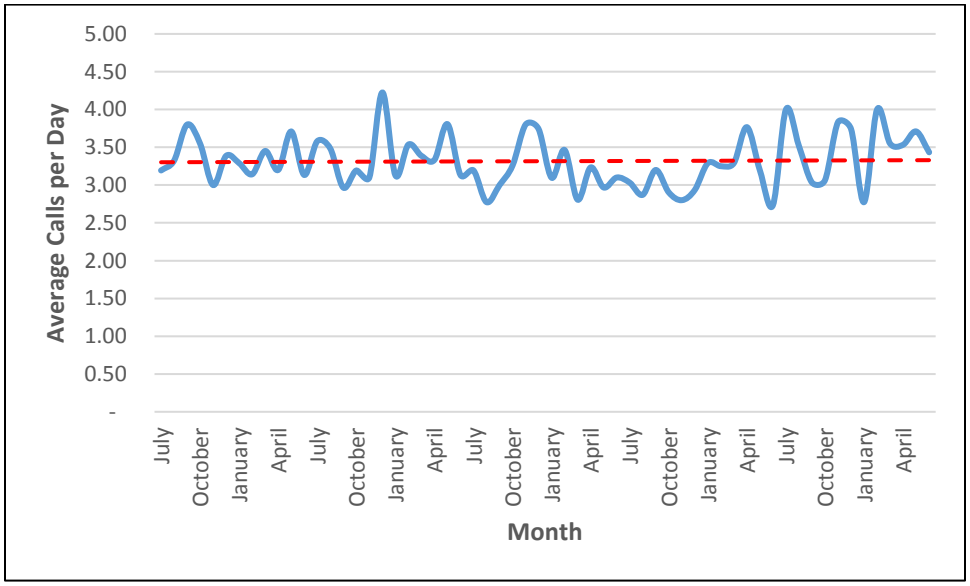


As mentioned, above, this chart shows that there has been a steady increase in workload in the Town over the same five-year period, from less than 12 calls per day to almost 14 calls per day. This is a significant increase over this short a period, and a trend which our model shows is likely to continue as development in and around the community continues to influence departmental workload.

Conclusion: Calls for service are increasing at a much faster rate inside the Town of Amherst than they are in the contract communities. These are a key driver in the possible need for additional staff in the AFD.

Recall that the Fire Department handles workload both inside the Town of Amherst and outside the Town under contract for providing EMS services. The next exhibit (Figure 2) shows the monthly average calls per day outside the Town of Amherst:

Figure 2: Average AFD Calls Per Day FY12-FY16 Calls Outside Amherst

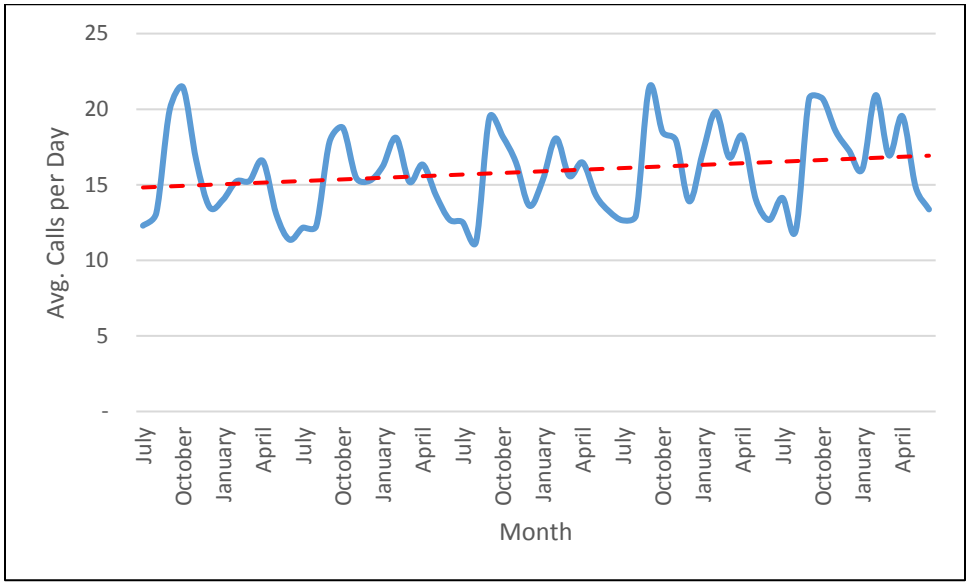


It is important to note that while the trend line (in red) is positive, it is barely so – increasing slightly over the five-year period. Monthly variation is minimal as well with no discernible seasonal pattern in the data.

Conclusion: Calls for service are slowly but steadily increasing in the four towns serviced under contract by the Town of Amherst. These are not driving demand for new staff in the AFD.

The next exhibit shows the combined workload for the Department depicted as average calls per month over the same five-year period. The impact of the seasonality of events from inside Amherst shows in this chart as well.

Figure 3: Average AFD Calls Per Day / FY12-FY16 All Calls



As a result of these two influences the volume of calls handled by the Amherst Fire Department is rising steadily from 15 calls per day in July 2011 to more than 17 calls per day in May 2016. This volume of workload is such that concurrent calls are inevitable, as are extended response times.

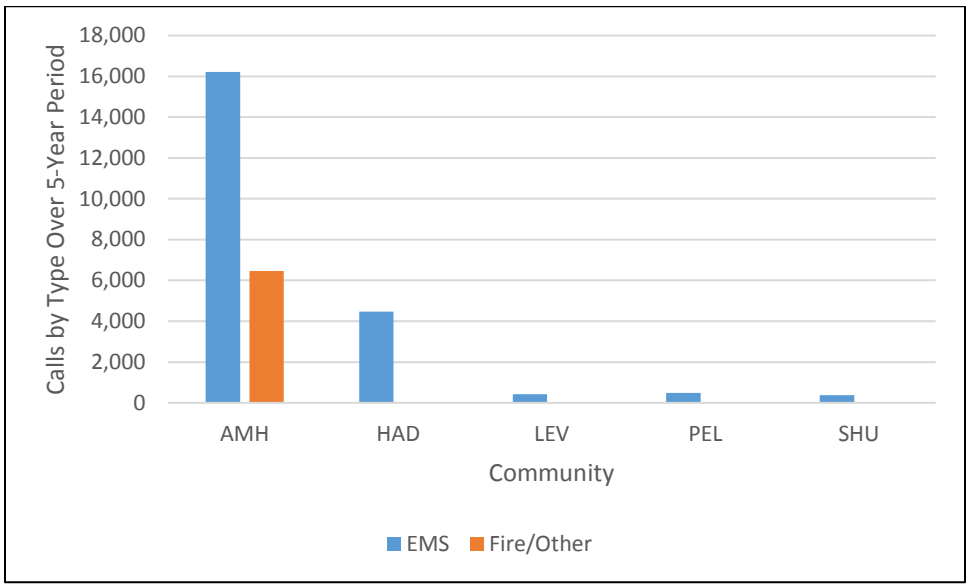
Conclusion: The AFD is experiencing call growth of more than two (2) calls per day over the five-year period. Subsequent analyses show that this is almost all coming from inside the Town of Amherst.

It is important to note some of the sources of this growth within the Town include these recent and projected projects:

1. Commonwealth College Dorms
2. Olympia Drive
3. Olympia Apartments
4. Kendrick Place Apartments
5. 1 East Pleasant Street
6. Beacon Project
7. Spring Street Apartments
8. Amherst Motel demo / Apartments
9. West Street Development
10. Assisted Living Facilities (e.e., 200 + calls from a single location)
11. New Urgent Care Facilities are known to increase call volumes

The next exhibit (Figure 4) shows the distribution of calls between emergency medical (EMS) and all other call types (since the EMS calls make up such a significant proportion of the calls). Note that Hadley's EMS calls make up approximately 25% of those in Amherst.

Figure 4: Distribution of Calls for Service (EMS and Other) / FY12-FY16 Calls by Town

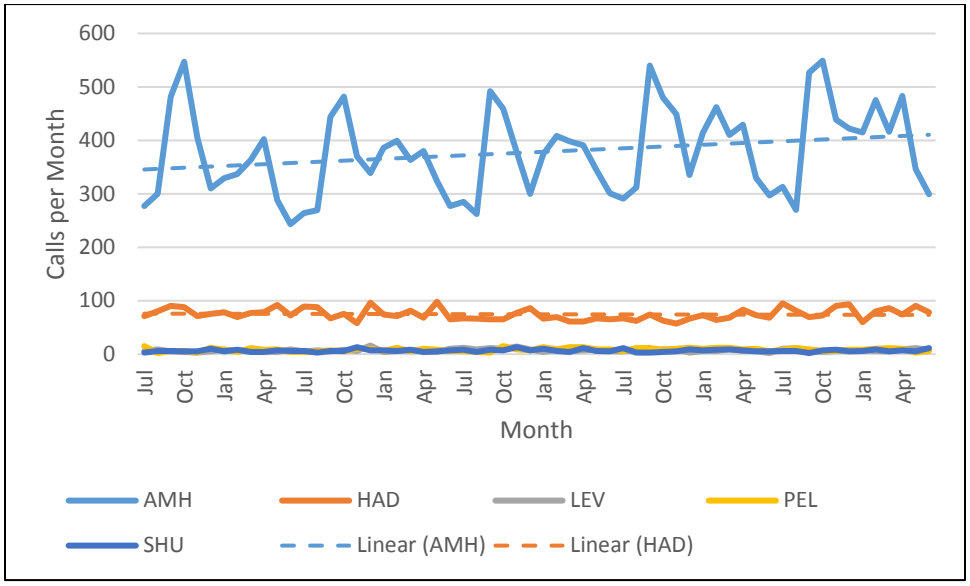


The majority of calls handled by the AFD in each community are EMS. In Amherst, where the AFD handles all fire / rescue / EMS activity, the proportion is 71% EMS. In the contract towns, the rates exceed 98% of calls – with the local jurisdictions handling their own rescue / fire workload. The resulting mix, when calls from the four contract towns are mingled with those of the Town of Amherst, is that approximately 80% of the workload handled by the AFD is EMS in nature. Also note that the Town of Hadley currently makes up roughly 25% of the overall EMS workload (around 3 calls per day).

Conclusion: The Town of Amherst makes up the majority of the calls for service handled by the AFD. Changes in call activity within the Town make up the most significant drivers on workload and therefore on staffing. More than 80% of the AFD's workload relates to EMS calls.

The next exhibit (Figure 5) shows the monthly distribution of calls for service handled by the AFD by community:

Figure 5: Distribution of Calls for Service (All Call Types) / FY12-FY16 Calls by Town by Month

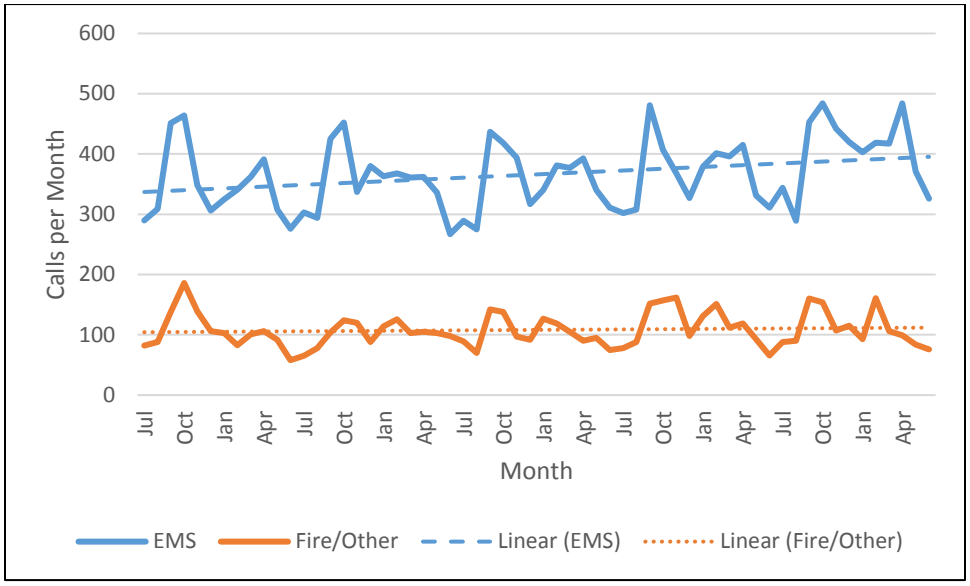


Particularly noteworthy in Figure 5 is the variance in workload in Amherst compared to the almost flat workload in the other towns. Note also that the blue trend line, for Amherst, is also rising, while the others are essentially flat. This shows that the workload in Amherst is driving call growth, while the impact of the other communities is much less impactful.

Conclusion: The workload profile for the Town of Amherst is significantly more subject to seasonal (i.e., monthly) variability than the contract communities. Any decisions to staff variably to account for seasonality comes from the Town of Amherst, and not from the contract towns.

The next exhibit (Figure 6) shows the distribution of calls (EMS and Other) across the same five-year time period.

Figure 6: Distribution of Calls for Service (All Towns) / FY12-FY16 Calls by Type of Call

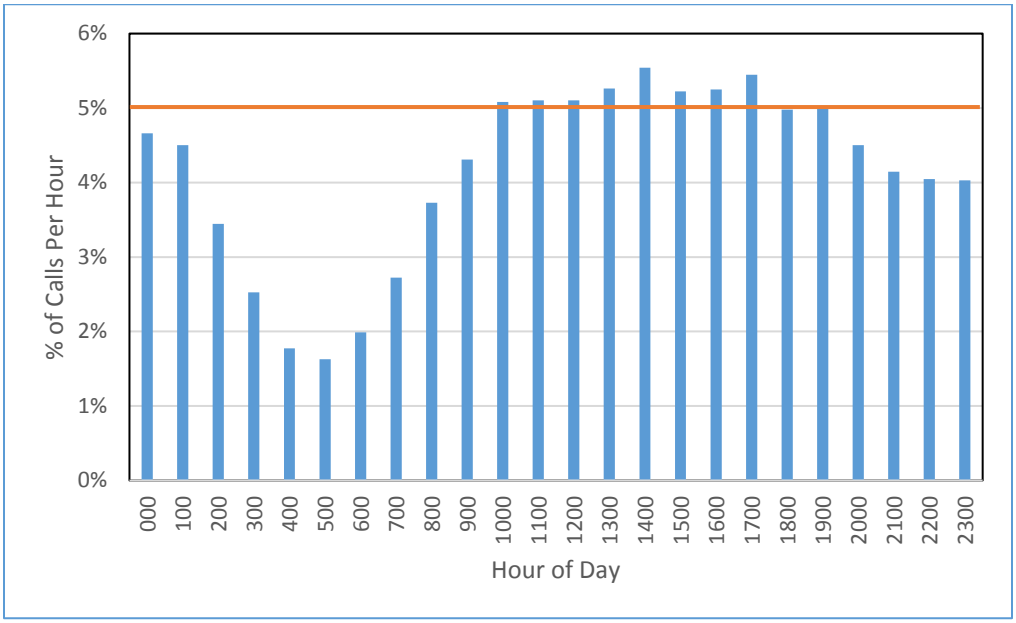


This is instructive as it shows that the primary driver in call volume continues to be EMS, which makes up a significant majority of all calls handled by the AFD.

Conclusion: EMS calls have been and will continue to be the significant driver of call volume and of call activity. Staffing decisions should be made primarily (but not solely) with reference to the impact of these calls.

The next exhibit (Figure 7) shows calls by hour of day as a percentage of total calls. Note that there is a clear busy period and clear drop off in workload - calls approach or exceed 5% of total daily calls from 10AM until 7PM, but are less than 3% from 3AM to 7AM.

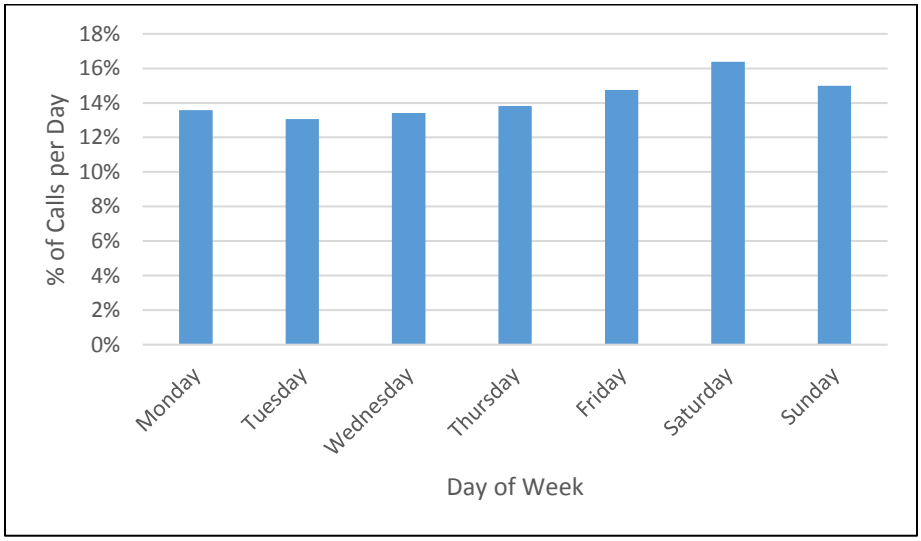
Figure 7: Distribution of Calls by Hour of Day FY12-FY16 All Calls Handled by the AFD



Conclusion: There is a clear distinction between the busiest time of the day and the rest of the day. This opens the possibility of exploring peak-hour staffing, enabling the Town to staff for the busier times of day and to drop staffing levels when work is likely to be slower.

The next exhibit (Figure 8) shows the breakdown of calls for service by day of week.

Figure 8: Distribution of Calls by Day of Week / FY12-FY16 All Calls Handled by the AFD



Note that there is a slight uptick for the weekend (Friday – Sunday) compared to the work week.

Conclusion: The uptick in workload on the weekends has been used to justify peak period staffing in the past (and going forward). This shows the Town's and AFD's experience and comfort with this approach.

Another way of looking at these data are to view them in terms of the average calls per hour per day of week, as shown in the following exhibit:

Figure 9: Calls for Service by Time of Day / Day of Week / Average Across Five Years
FY12-FY16 All Calls Handled by the AFD

Hours	Monday	Tuesday	Wednes.	Thursday	Friday	Saturday	Sunday	Total
0000	0.48	0.42	0.45	0.43	0.62	1.32	1.37	**0.73**
0100	0.53	0.36	0.40	0.44	0.58	1.29	1.45	**0.72**
0200	0.41	0.34	0.39	0.34	0.46	1.11	0.91	**0.57**
0300	0.33	0.28	0.31	0.24	0.36	0.58	0.67	**0.40**
0400	0.27	0.25	0.23	0.24	0.33	0.34	0.37	**0.29**
0500	0.23	0.30	0.27	0.20	0.26	0.33	0.26	**0.27**
0600	0.37	0.29	0.35	0.33	0.32	0.30	0.34	**0.33**
0700	0.41	0.41	0.41	0.51	0.55	0.38	0.40	**0.44**
0800	0.70	0.76	0.69	0.64	0.65	0.48	0.56	**0.64**
0900	0.78	0.68	0.75	0.76	0.70	0.67	0.61	**0.71**
1000	0.84	0.94	0.82	0.87	1.03	0.66	0.64	**0.83**
1100	0.92	0.77	0.83	0.89	0.90	0.75	0.83	**0.84**
1200	0.85	0.79	0.86	0.82	0.90	0.90	0.83	**0.85**
1300	0.75	0.93	0.86	0.95	0.83	0.80	0.85	**0.85**
1400	0.90	0.90	0.88	0.94	0.87	0.98	0.81	**0.94**
1500	0.97	0.96	0.89	0.83	0.84	0.79	0.74	**0.86**
1600	0.94	0.81	0.90	0.92	0.87	0.87	0.73	**0.86**
1700	0.93	0.98	0.92	0.93	0.88	0.89	0.74	**0.90**
1800	0.86	0.78	0.87	0.86	0.80	0.86	0.73	**0.82**
1900	0.76	0.90	0.75	0.84	0.86	0.80	0.79	**0.81**
2000	0.71	0.74	0.73	0.71	0.81	0.83	0.67	**0.74**
2100	0.61	0.63	0.62	0.77	0.73	0.67	0.67	**0.67**
2200	0.53	0.52	0.50	0.69	0.84	0.93	0.66	**0.67**
2300	0.51	0.49	0.59	0.63	1.04	0.97	0.54	**0.68**
Total	**0.65**	**0.64**	**0.64**	**0.66**	**0.71**	**0.77**	**0.72**	**0.68**

To better understand this, we examined the workload in a matrix showing both time of day and day of week. This is shown in the following exhibit (Figure 10) which shows the distribution of all calls for service regardless of type:

Figure 10: Calls for Service by Time of Day / Day of Week / FY12-FY16 All Calls Handled by the AFD

Hr	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
0000	0.46%	0.39%	0.44%	0.39%	0.60%	1.19%	1.19%
0100	0.46%	0.29%	0.36%	0.40%	0.53%	1.22%	1.24%
0200	0.36%	0.28%	0.33%	0.29%	0.42%	0.95%	0.82%
0300	0.28%	0.25%	0.25%	0.24%	0.32%	0.55%	0.64%
0400	0.24%	0.20%	0.23%	0.19%	0.29%	0.30%	0.33%
0500	0.20%	0.27%	0.25%	0.18%	0.22%	0.28%	0.24%
0600	0.27%	0.27%	0.30%	0.31%	0.28%	0.27%	0.29%
0700	0.38%	0.38%	0.39%	0.44%	0.45%	0.34%	0.34%
0800	0.58%	0.62%	0.57%	0.55%	0.51%	0.42%	0.49%
0900	0.68%	0.55%	0.68%	0.69%	0.63%	0.56%	0.52%
1000	0.75%	0.79%	0.74%	0.80%	0.88%	0.56%	0.56%
1100	0.82%	0.67%	0.72%	0.79%	0.74%	0.62%	0.74%
1200	0.76%	0.69%	0.78%	0.70%	0.76%	0.74%	0.68%
1300	0.68%	0.80%	0.75%	0.85%	0.73%	0.75%	0.71%
1400	0.80%	0.75%	0.78%	0.81%	0.79%	0.91%	0.70%
1500	0.82%	0.81%	0.72%	0.75%	0.74%	0.74%	0.64%
1600	0.81%	0.66%	0.80%	0.80%	0.78%	0.75%	0.65%
1700	0.81%	0.83%	0.84%	0.80%	0.73%	0.76%	0.67%
1800	0.76%	0.69%	0.72%	0.74%	0.71%	0.75%	0.63%
1900	0.67%	0.77%	0.67%	0.71%	0.73%	0.73%	0.71%
2000	0.60%	0.63%	0.61%	0.62%	0.69%	0.73%	0.62%
2100	0.53%	0.56%	0.53%	0.71%	0.65%	0.61%	0.55%
2200	0.46%	0.46%	0.46%	0.54%	0.76%	0.81%	0.57%
2300	0.41%	0.45%	0.49%	0.54%	0.82%	0.87%	0.46%

The high-lighted areas indicate those which are in excess of 0.65% [10] of the total calls for service.

Conclusion: There are clear periods of increased workload – these shift slightly across the week, but for the most past are between 9AM and 8PM hours. This would allow for peak period staffing of an additional unit to meet call demand. A measure of the success of this effort will be to reduce the incidence of call back of staff for station coverage.

[10] 0.65% was selected to show the busiest half of the hours across all seven weekdays. It actually results in 54% of the hours being highlighted.

The next exhibit (Figure 11) shows the same analysis applied to EMS calls only:

Figure 11: Calls for Service by Time of Day/Day of Week / FY12-FY16 EMS Calls by the AFD

Hr	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
0000	0.45%	0.33%	0.41%	0.35%	0.65%	1.24%	1.25%
0100	0.44%	0.29%	0.37%	0.38%	0.58%	1.27%	1.30%
0200	0.39%	0.30%	0.35%	0.28%	0.43%	0.99%	0.83%
0300	0.30%	0.24%	0.27%	0.26%	0.33%	0.61%	0.70%
0400	0.26%	0.22%	0.24%	0.19%	0.29%	0.30%	0.33%
0500	0.20%	0.28%	0.25%	0.20%	0.23%	0.28%	0.25%
0600	0.27%	0.27%	0.30%	0.33%	0.26%	0.28%	0.32%
0700	0.41%	0.34%	0.42%	0.44%	0.44%	0.32%	0.37%
0800	0.57%	0.60%	0.59%	0.53%	0.50%	0.40%	0.50%
0900	0.66%	0.57%	0.64%	0.72%	0.61%	0.61%	0.60%
1000	0.81%	0.89%	0.77%	0.80%	0.91%	0.58%	0.59%
1100	0.88%	0.65%	0.73%	0.80%	0.69%	0.58%	0.77%
1200	0.77%	0.71%	0.81%	0.72%	0.72%	0.73%	0.72%
1300	0.64%	0.75%	0.76%	0.87%	0.77%	0.76%	0.71%
1400	0.72%	0.79%	0.74%	0.78%	0.82%	0.99%	0.68%
1500	0.80%	0.80%	0.72%	0.76%	0.75%	0.73%	0.63%
1600	0.79%	0.69%	0.79%	0.76%	0.77%	0.81%	0.65%
1700	0.80%	0.79%	0.78%	0.79%	0.71%	0.77%	0.65%
1800	0.72%	0.62%	0.67%	0.73%	0.65%	0.73%	0.59%
1900	0.68%	0.65%	0.58%	0.70%	0.75%	0.70%	0.69%
2000	0.58%	0.60%	0.57%	0.60%	0.65%	0.74%	0.60%
2100	0.48%	0.55%	0.49%	0.70%	0.68%	0.53%	0.56%
2200	0.42%	0.45%	0.42%	0.53%	0.79%	0.76%	0.57%
2300	0.42%	0.43%	0.54%	0.54%	0.84%	0.88%	0.43%

This shows a similar distribution of workload to the "all calls" exhibit shown previously.

Conclusion: because EMS calls account for 80% of the AFD's current workload, it is not surprising that there is a similar time of day and day of week distribution for the EMS calls for service. This further supports the idea of peak-period staffing, at least as an initial approach to addressing staffing needs. Note that there is an additional and significant period of activity on Friday and Saturday nights.

The following exhibit (Figure 12) illustrates current response times to calls for service in the Town of Amherst. This figure depicts average response times for the initial unit to all calls for service.[11]

Figure 12: Average Response Times to Calls for Service (by day of Week) in the Town of Amherst

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
5:38	5:41	5:50	5:36	5:52	5:34	5:58

Conclusion: The AFD is providing consistent response times across the week within the Town.

The following exhibit illustrates current response times to calls for service in the four contract towns. This figure depicts average response times.

Figure 13: Average Response Times to Calls for Service (by Day of Week) in the Contract Towns

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
9:06	8:27	8:33	8:53	8:39	8:59	8:43

The fact that calls for service take longer to respond to in the contract communities is unsurprising given the travel distances involved in reaching some areas.

Conclusion: The AFD is providing consistent response times across the week outside of the Town. Response times are longer, given travel distances.

The next exhibits (Figure 14) show the average response time by month within the Town of Amherst and for calls that occur outside the Town in the contract service communities.

Figure 14: Average Response Times to Calls for Service (by Month) in the Town of Amherst

July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
5:48	5:38	5:56	5:34	6:06	5:24	5:32	6:10	5:33	5:36	5:30	5:55

[11] The idea of "response" time is a complicated one. From the perspective of the caller, "response time" is the time from when they pick up the phone until a unit arrives. From the Fire Department's perspective, it is the elapsed time from dispatch until they arrive. The analyses contained in this report are from the Fire Department perspective, as they have no control over the processing of incoming calls for service.

Conclusion: The AFD is providing consistent response times across the year within the Town. This supports the peak period staffing approach currently in use.

Figure 15: Average Response Times to Calls for Service (by Month) in the Four Contract Towns

July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
8:39	9:20	8:57	8:48	8:15	8:38	8:58	8:38	8:15	9:16	8:42	9:32

Conclusion: The AFD is providing consistent response times across the year outside the Town in the contract towns. This supports the peak period staffing approach currently in use.

Despite the seasonal increases in workload shown in Figure 2 and Figure 3, there is no seasonal pattern to changes in response times. While none of these response times meet the targets set forth in NFPA 1710 (which would be 90% of calls reached in four minutes or less – which roughly equates to an average response time of between 2:00 and 2:30 minutes, these response times are within the range found in other suburban centers found in otherwise rural areas. [12] Improvements in response times would require, in all likelihood, the construction and staffing of one or more additional fire stations, actions not justified by the workload in the community. Adding staff to existing stations will not likely result in significant changes in response times.

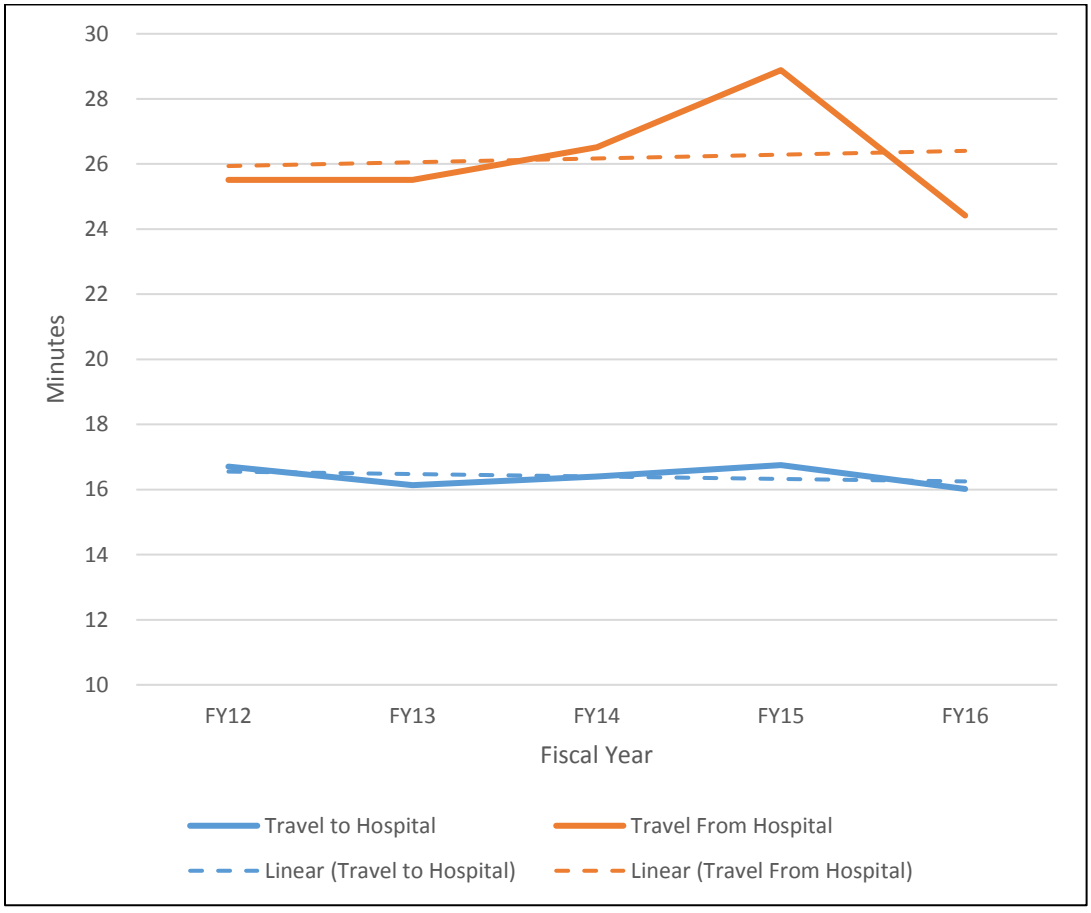
[12] The Town of Amherst serves as a "center community" to a number of the surrounding towns. While the Town has suburban characteristics (population, density, makeup) it is surrounded by very rural communities. Illustratively, the Town of Amherst has a population density of 1,365 / sq. mile (according to the 2010 Census), while Hampshire County (including Amherst) has a population density of 300 / sq. mile. Amherst is the largest community in the County – bigger than the County seat, Northampton.

Another interesting way of looking at the workload in the Amherst Fire Department is to see the time it takes for each call, in three interesting measures.

- Total time committed to each call (on average).
- Time it takes to get to the hospital (on average).
- Time it takes to get back to Amherst from the hospital (on average).

These figures are vital for assessing the likelihood of concurrent calls (which means the need for more than one unit to handle the workload) and the overall need for staffing in the Fire Department. The next exhibit (Figure 16) shows that there is a slight increase in the time it takes to travel back to Amherst from the hospital, but that travel time to the hospital has remained relatively stable over the past five years:

Figure 16: Average Drive Times to and From Hospital (by Fiscal Year) for all EMS Calls + Transport



Conclusion: The lengthy travel time to and from the hospital (in excess of 45 minutes) has an impact of staffing and on the availability of on-duty personnel. A typical EMS call for service will take between one and two hours. This increases the likelihood that additional resources will be required to handle the "next" call.

One final factor should be considered for its impact on the level of activity in the Town of Amherst, and that is the impact of concurrent call activity. Concurrent call activity, at its most basic, is simply this: if a call starts prior to a call dispatched previously ends, that is a concurrent call. The project team looked at concurrent in two ways: dispatched vs. cleared (i.e., technically available – though this could mean that the unit was in Northampton leaving the hospital) and dispatched vs. "in quarters" meaning that the unit had arrived at its home station.

Both of these definitions have some challenges when applied to Amherst. In the first case, an ambulance which is "available" for a call but is responding from Northampton may not be a practical first response selection due to its extended travel time. In the second case, waiting for an ambulance to arrive "in quarters" ignores its proximity to or presence in the Town of Amherst, AND / OR it ignores the fact that a unit may pick up a second call prior to returning to quarters.

The exhibit (Figures 17) which follows shows the level of concurrency in the Town of Amherst's response area:

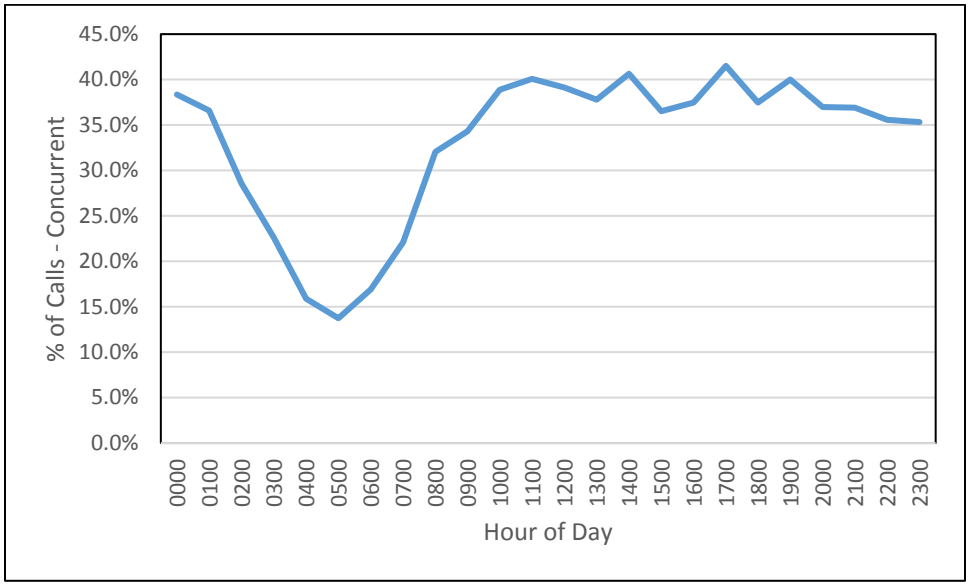
Figure 17A: Concurrent Calls (All Types) 2011-2016 Dispatch vs. Cleared

	At Least		
# of Calls	**2 Calls**	**3 Calls**	**4 Calls**
Concurrent Calls	10,026	2,661	530
Total Call Handled	28,727	28,727	28,727
% Concurrency	34.9%	9.3%	1.8%

Figure 17B: Concurrent Calls (All Types) 2011-2016 Dispatch vs. In Quarters

	At Least		
# of Calls	**2 Calls**	**3 Calls**	**4 Calls**
Concurrent Calls	13,107	4,204	996
Total Call Handled	28,727	28,727	28,727
% Concurrency	45.6%	14.6%	3.5%

Figure 18: Concurrent Calls (All Types) 2011-2016 Dispatch vs. Cleared By Time of Day



Conclusion: The AFD is dealing with a concurrent call rate of more than 35%. This shows that the Town needs to be able to deploy two or three ambulances using on-duty personnel on a regular basis. Note that the risk of concurrency drops significantly at 0000 (midnight) before rising sharply again at 0700 (7AM). This can be thought of as less an issue of 'occurrence' and more an issue of 'concurrence.' The lengthy drive times are resulting in a higher level of concurrent call activity than the workload itself would suggest.

4. Staffing Alternatives

The Amherst Fire Department has long relied upon three sources of staffing, as discussed above:

- Full-time career personnel to handle the bulk of routine activities.
- On-call personnel to respond to major events and to back-up full-time staff.
- Student volunteers, who perform similar toles to the on-call force, and who enhance community participation in emergency response.

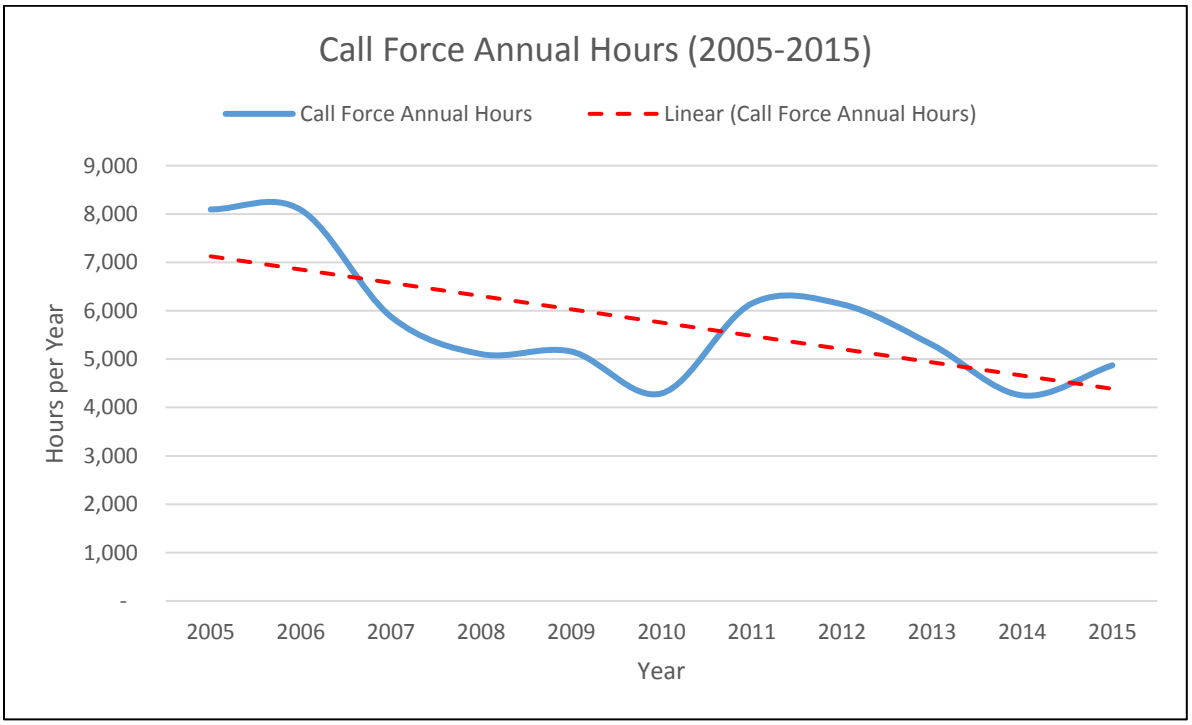
The Town of Amherst, like many communities in Massachusetts, uses a model of on-duty career staffing, calling back personnel, and supplementing career personnel with Call Force. What makes Amherst different is that career personnel are also supplemented with responders from the Student Force. The next exhibits examine some measures of these factors, including "call backs" – which are requests for station coverage when on-duty personnel have been depleted due to concurrent active calls.

It is important to underscore that the use of "call back" for Station Coverage is slightly different for each of the three sources of personnel. This is summarized, below:

- Career (or Permanent) Force personnel are toned in for station coverage when the on-duty personnel are depleted to less than three available AND the Student Force is not in-service with a duty crew. This typically occurs during weekdays (between 7AM and 6PM) and during summer and intersession breaks.
- Call Force personnel are toned for Station Coverage only after the Permanent Force has been called and been unable to provide the request response for coverage.
- Student Force are not "called back" – they are either in service or they are not. Since they are not allowed to leave town, they are counted as "available" when in-service.
- As noted, above, the Call Force was called upon for station coverage 115 times and the Student Force provided coverage 71 times.

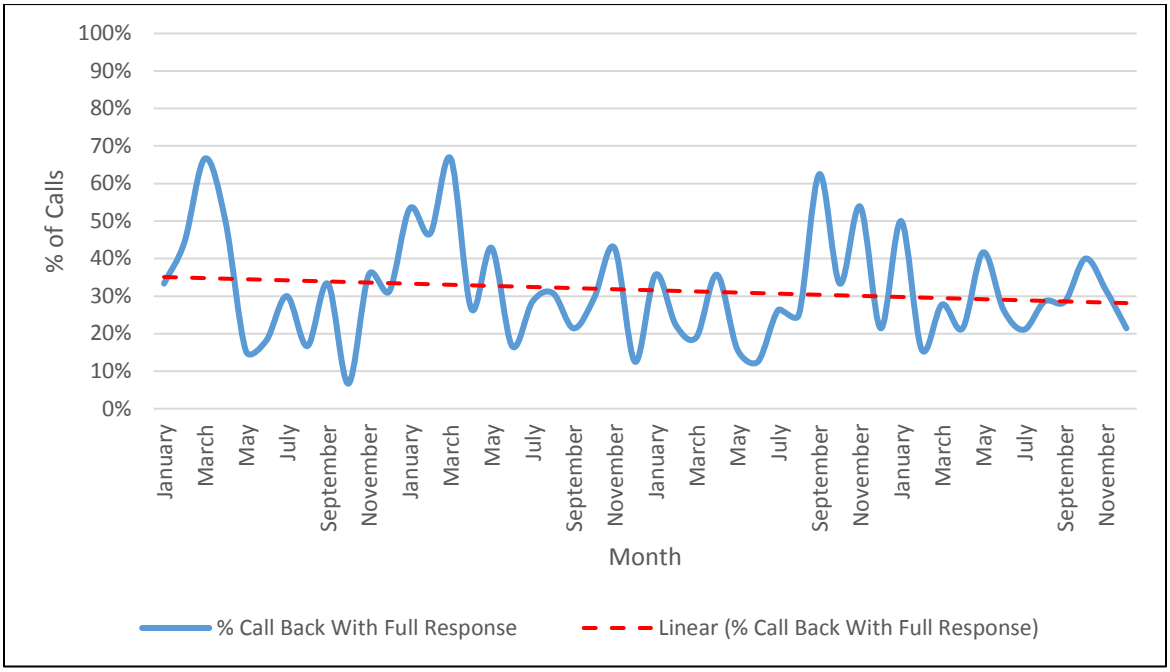
Note that call force participation, which includes both drills and emergency responses, has been dropping steadily over the past 10 years. The exhibit below (Figure 19) shows the steady decline in call force participation – even as call volume has increased over the same period:

Figure 19: Change in On-Call Response Hours



The following exhibit (Figure 20) shows the steady decline (despite monthly fluctuations) from approximately 35% of call backs to 28% in recent months receiving a full response:

Figure 20: Call Backs Receiving a Full Response [13] Percent of Calls (2011-2016)



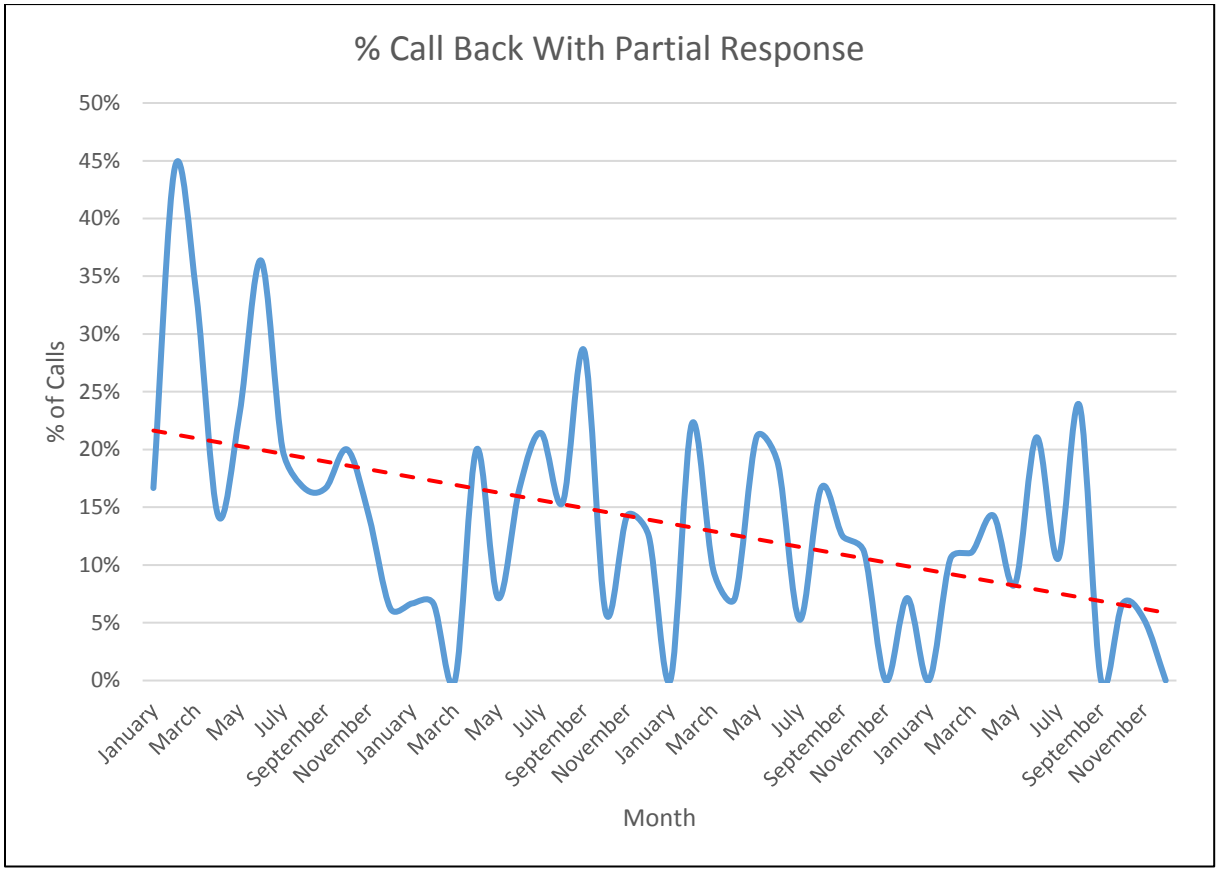
Conclusion: The Amherst Fire Department is seeing a declining level of full response to call backs for station coverage. This has been steadily declining over the past five years. The clear resulting policy choice that results from these data is: either mandate higher level of response from staff and paid-on-call personnel (unlikely to be successful) or look to altered deployment or increased staffing to address current shortfalls in coverage.

Conclusion: The current staffing model provides for an effective response (with the exception of the need to provide for increased staffing during peak periods as discussed in this report). However, it is critical to understand that declining participation from the two supplemental forces (Student and Call) will almost certainly have to be met with additional career resources.

[13] A full response is defined by the AFD as one in which 100% of the requested positions to be filled on call back are filled. Call back can be filled by either off-duty full time personnel, paid-call personnel, or qualified student volunteers.

The following exhibit (Figure 21) shows an even steeper decline in those calls backs which receive a partial response:

Figure 21: Calls Backs Receiving a Partial Response [14] Percentage of Calls (2011-2016)



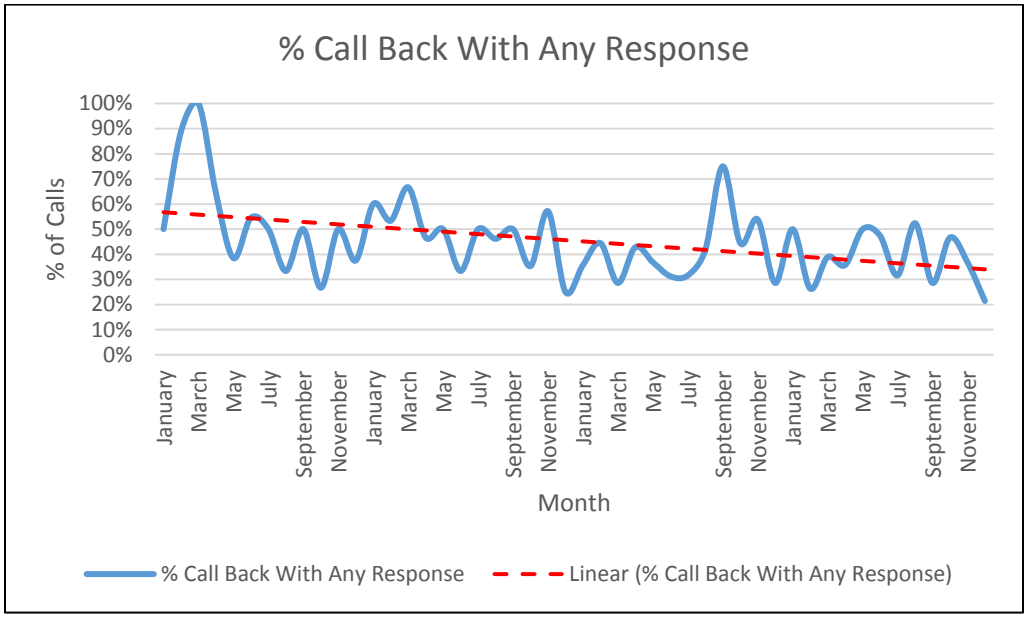
Conclusion: There is a very stark decline in the response which receive at least a partial response (i.e., when one person responds instead of the two requested).

Even more troubling analysis is shown when one examines the availability of ANY response from off-duty fulltime or call personnel. This is shown in the following exhibit (Figure 22) which shows a dramatic five-year decline from almost 60% to less than 35% receiving at least some response. This decreasing availability for out-of-station personnel to respond back to the department appears to be driven by several factors that are local and more broadly societal. People increasingly work in places away from their home community – making it less and less easy to

[14] A partial call back is defined by the AFD as one in which at least one person responds for call back to cover the station, but short of a full response comes in. Call back can be filled by either off-duty full time personnel, paid-call personnel, or qualified student volunteers.

respond when called to volunteer. A number of other factors have been identified as well (see foot note #1).

Figure 22: Call Backs Receiving Any Response [15] Percentage of Calls (2011-2016)



Conclusion: The Town of Amherst can be decreasingly reliant on off-duty personnel or call personnel to provide coverage on call back.

5. Recommendations

Each of these ways of examining the available call back data show that the Town of Amherst is increasingly reliant on those personnel who are on-duty to handle the workload in the community and in the contract EMS communities.

- **Recommendation:** Like many communities of similar size in the United States the Town of Amherst struggles to balance service delivery objectives for public safety, and budgetary constraints. Maintaining the ability to staff at least one engine and two ambulances (7 personnel) has been the historic approach. The Department has the workload to justify increased staffing, and should be moving towards staffing at least an engine and three ambulances (9 personnel). The Fire Department is able to avoid increased staffing levels, currently, due to the continued availability of the Student and Call Forces. Were either of both of these two staffing sources to significantly decline or

[15] "Any Response" is defined by the AFD as call back where either a partial or a full response to the call back for coverage request is made. See the preceding footnotes for definitions. Call back can be filled by either off-duty full time personnel, paid-call personnel, or qualified student personnel.

become unavailable, the Town would have to revisit the total staffing needs for the Department. *The peak period staffing program would help the Department move towards achieving these objectives cost effectively, and matched up against the times of day when calls are most likely to occur.*

- **Recommendation**: The AFD should implement a program of staffing a peak-load ambulance to assist with the reduction of call back (reducing the impact on full-time and other personnel). This should be done with new personnel. There are two options that could be considered:
    - **Option 1:** Staff seven days a week for 12-hours a day (9A – 9P). This would require hiring 4 personnel. They could work in a schedule of either 3-3-4-4 or 2-2-3-3 [16]which provides for a 42-hour average work week. Hiring four firefighter paramedics would cost approximately $400,000 [17] based on most recent Finance Department figures.
    - **Options 2:** Staff five days a week using 2 personnel, 8-hours per day. This would cost approximately $200,000 in salaries per year for the two firefighter paramedics. (See the Figure 23).

[16] In the 3-3-4-4 or 2-2-3-3 (and there are many others) rotation, personnel are assigned to two "groups" working opposite one another. In the first example, Group A would be on for three days, off for three days, on for four days, off for four days. Group B would be off when Group A is working, and working when Group A is off.

[17] This is an "all in" cost and includes salaries, health insurance, pensions, and other associated costs.

Figure 23: Suggested 8-Hour Coverage With Peak Time Ambulance

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
000	0.46%	0.39%	0.44%	0.39%	0.60%	1.19%	1.19%
100	0.46%	0.29%	0.36%	0.40%	0.53%	1.22%	1.24%
200	0.36%	0.28%	0.33%	0.29%	0.42%	0.95%	0.82%
300	0.28%	0.25%	0.25%	0.24%	0.32%	0.55%	0.64%
400	0.24%	0.20%	0.23%	0.19%	0.29%	0.30%	0.33%
500	0.20%	0.27%	0.25%	0.18%	0.22%	0.28%	0.24%
600	0.27%	0.27%	0.30%	0.31%	0.28%	0.27%	0.29%
700	0.38%	0.38%	0.39%	0.44%	0.45%	0.34%	0.34%
800	0.58%	0.62%	0.57%	0.55%	0.51%	0.42%	0.49%
900	0.68%	0.55%	0.68%	0.69%	0.63%	0.56%	0.52%
1000	0.75%	0.79%	0.74%	0.80%	0.88%	0.56%	0.56%
1100	0.82%	0.67%	0.72%	0.79%	0.74%	0.62%	0.74%
1200	0.76%	0.69%	0.78%	0.70%	0.76%	0.74%	0.68%
1300	0.68%	0.80%	0.75%	0.85%	0.73%	0.75%	0.71%
1400	0.80%	0.75%	0.78%	0.81%	0.79%	0.91%	0.70%
1500	0.82%	0.81%	0.72%	0.75%	0.74%	0.74%	0.64%
1600	0.81%	0.66%	0.80%	0.80%	0.78%	0.75%	0.65%
1700	0.81%	0.83%	0.84%	0.80%	0.73%	0.76%	0.67%
1800	0.76%	0.69%	0.72%	0.74%	0.71%	0.75%	0.63%
1900	0.67%	0.77%	0.67%	0.71%	0.73%	0.73%	0.71%
2000	0.60%	0.63%	0.61%	0.62%	0.69%	0.73%	0.62%
2100	0.53%	0.56%	0.53%	0.71%	0.65%	0.61%	0.55%
2200	0.46%	0.46%	0.46%	0.54%	0.76%	0.81%	0.57%
2300	0.41%	0.45%	0.49%	0.54%	0.82%	0.87%	0.46%

- **Recommendation –** The Town of Amherst should consider this peak-period ambulance staffing option for a period of not less than one year. To evaluate the success of this program, the Carlson Group recommends the following measures for success:
    - Have the number of call backs for coverage been reduced?
    - Have response times been lowered during the hours of operation of the peak-period ambulance?
- **Recommendation –** The Town should add language into their future EMS contracts, which are to be commended for their simplicity, clearly stating that any and all revenues collected by the Town through its provision of ambulance transportation, are to be kept by the Town of Amherst.
- **Recommendation –** The Town should continue to examine the costs / benefits associated with maintaining the Student Force and the Call Force. This should include assessing on-going availability, costs, equipment maintenance, operating expenses,

training costs, etc. Support from the University for the programs should also be taken into account.

- **Recommendation –** The Amherst Fire Department operates multiple ambulances, all at the ALS (paramedic) level. This requires that the majority of personnel be paramedics, given the flexibility required in the current system of staffing ambulances.

6. APPENDIX – SERVICE LEVELS

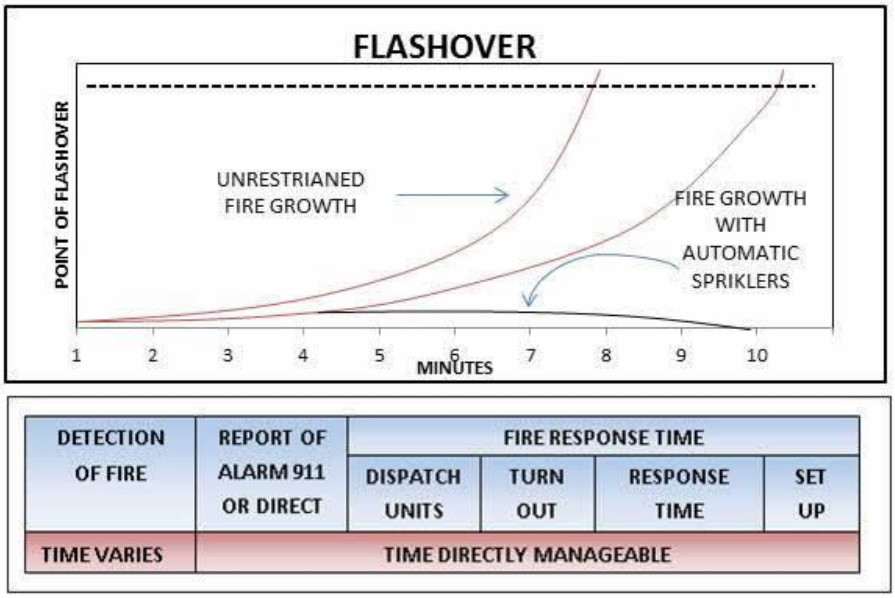
The adoption of performance standards for fire and EMS response is a critical first step in the evaluation of service levels and staffing alternatives. While there are national standards that can be used to evaluate fire and EMS service delivery, each community must identify the key risks and necessary level of protection it needs based on its own unique circumstances. Once these performance standards are established a community can assess its performance and determine if current resources support the desired level of service.

Nationwide, a great deal of effort and research has been put into developing performance objectives for the delivery of fire and EMS services. This effort is critical for agencies making decisions about deployment and location of emergency resources. The objectives promoted for fire/rescue and EMS have their basis in research that has been conducted into two critical issues:

- What is the critical point in a fire's "life" for gaining control of the blaze while minimizing the impact on the structure of origin and on those structures around it?
- What is the impact of the passage of time on survivability for victims of cardiac arrest?

The exhibit, that follows, shows a typical "flashover" curve for interior structure fires. The point in time represented by the occurrence of "flashover" is critical because it defines when all of the contents of a room become involved in the fire. This is also the point at which a fire typically shifts from "room and contents" to a "structure" fire – involving a wider area of the building and posing a potential risk to the structures surrounding the original location of the fire.

Figure 24: Typical Fire Flashover Timeline



Note that this exhibit depicts a fire from the moment of inception – not from the moment that a fire is detected or reported. This demonstrates the criticality of early detection and fast reporting as well as rapid dispatch of responding units. This also shows the critical need for a rapid (and sufficiently staffed) initial response – by quickly initiating the attack on a fire, "flashover" can be averted. The points, below, describe the major changes that occur at a fire when "flashover" occurs:

- It is the end of time for effective search and rescue in a room involved in the fire. It means that likely death of any person trapped in the room – either civilian or firefighter.
- After this point in a fire is reached, potable extinguishers can no longer have a successful impact on controlling the blaze. Only larger hand-lines will have enough water supply to affect a fire after this point.
- The fire has reached the end of the "growth" phase and has entered the fully developed phase. During this phase, every combustible object is subject to the full impact of the fire.
- This also signals the changeover from "contents" to "structure" fire. This is also the beginning of collapse danger for the structure. Structural collapse begins to become a major risk at this point and reaches the highest point during the decay stage of the fire (after the fire has been extinguished).

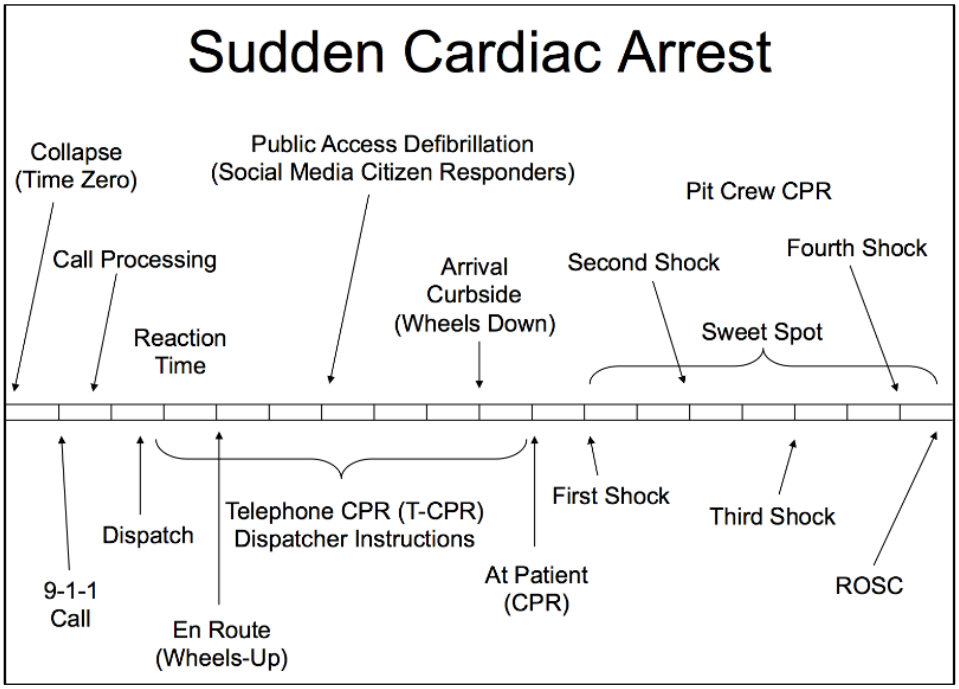
It should be noted that not every fire will reach flashover – and that not every fire will "wait" for the 8-minute mark to reach flashover. A quickly responding fire crew can do things to prevent or delay the occurrence of flashover. These options include:

- Application of portable extinguisher or other "fast attack" methodology.
- Venting the room to allow hot gases to escape before they can cause the ignition of other materials in the room.
- Not venting a room – under some circumstances this will actually stifle a fire and prevent flashover from occurring.

Each of these techniques requires the rapid response of appropriately trained fire suppression resources that can safely initiate these actions. In the absence of automatic fire suppression systems, access to interior fires can again limited by a safety requirement related to staffing levels. OSHA and related industry standards require the presence of at least 2-firefighters on the exterior of a building before entry can be made to a structure in which the environment has been contaminated by a fire. In the absence of a threat to life demanding immediate rescue, interior fire suppression operations are limited to the extent a fire service delivery system can staff to assure a minimum of 4-people actively involved in firefighting operations. The second issue to consider is the delivery emergency medical services. One of the primary factors in the design of emergency medical systems is the ability to deliver basic CPR and defibrillation to the

victims of cardiac arrest. The exhibit, that follows, demonstrates the survivability of cardiac patients as related to time from onset:

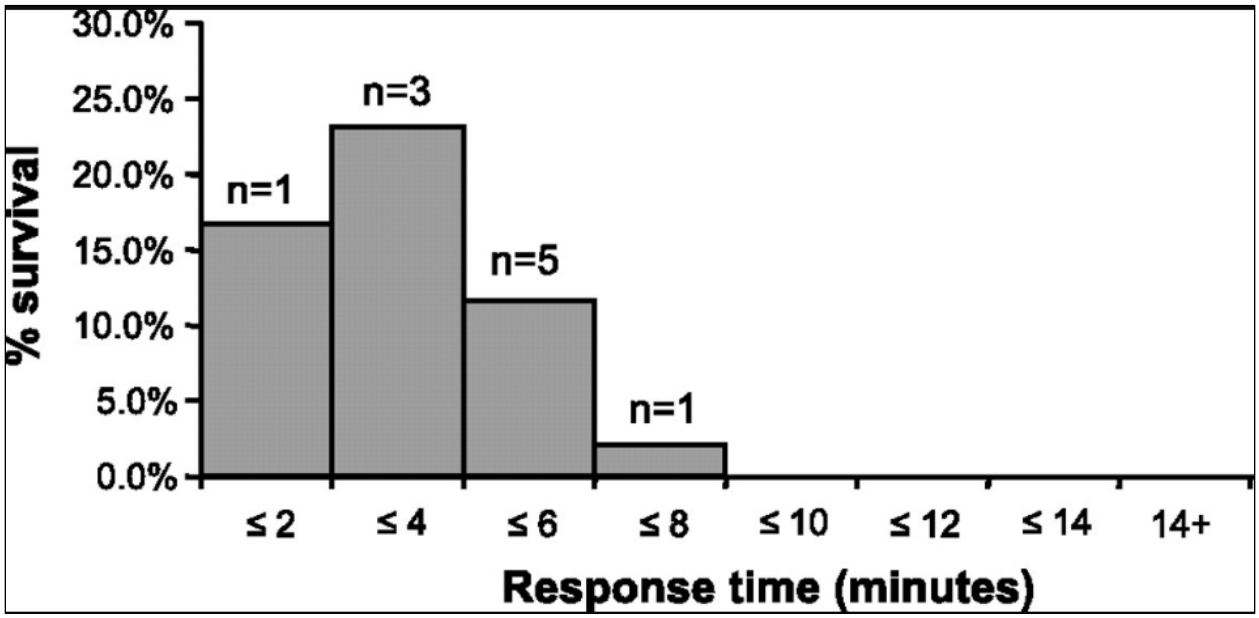
Figure 25: Typical Cardiac Arrest Timeline



This graph illustrates that the chances of survival of cardiac arrest diminish approximately 10% for each minute that passes before the initiation of CPR and/or defibrillation. These dynamics are the result of extensive studies of the survivability of patients suffering from cardiac arrest. While the demand for services in EMS is wide ranging, the survival rates for full-arrests are often utilized as benchmarks for response time standards as they are more readily evaluated because of the ease in defining patient outcomes (a patient either survives or does not). This research results in the recommended objective of provision of basic life support within 4-minutes of notification and the provision of advanced life support within 8 minutes of notification. The goal is to provide BLS within 6 minutes of the onset of the incident (including detection, dispatch and travel time) and ALS within 10 minutes. This is often used as the foundation for a two-tier system where fire resources function as first responders with additional (ALS) assistance provided by responding ambulance units and personnel.

With cardiac arrest – and opioid overdose has a similar timeline – rapidity of initial treatment (CPR, AED, drugs) can have a significant impact on patient survival outcomes:

Figure 26: Cardiac Arrest Survival Rate vs. Timeline



Additional research shows the impact and efficacy of rapid deployment of automatic defibrillators to cardiac arrests. This research – conducted in King County (WA), Houston (TX) and as part of the OPALS study in Ontario, Canada – shows that the AED can be the largest single contributor to the successful outcome of a cardiac arrest – particularly when accompanied by early delivery of CPR. It is also important to note that these medical research efforts have been focused on a small fraction of the emergency responses handled by typical EMS systems – non-cardiac events make up the large majority of EMS and total system responses and this research does not attempt to address the need for such rapid (and expensive) intervention on these events.

The results of these research efforts have been utilized by communities and first responders, often on their own with no single reference, to develop local response time and other performance objectives. However, there are now three major sources of information to which responders and local policy makers can refer when determining the most appropriate response objectives for their community:

- The Insurance Services Office (ISO) provides basic information regarding distances between fire stations. However, this "objective" does little to recognize the unique nature of every community's road network, population, calls for service, call density, etc.

- The National Fire Protection Association (NFPA) promulgated a documented entitled: "NFPA 1710: Objective for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments." This document (NFPA 1710) was first published in 2001 and updated in every several years – has and generated a great deal of dialogue and debate – which is still on going. This document is not a requirement for communities to follow – local authorities can and must determine for themselves an appropriate service level – but it is an important starting point for most service level discussions.
- The Commission on Fire Accreditation International (CFAI) in its "Objectives of Coverage" manual places the responsibility for identifying "appropriate" response objectives on the locality. These objectives should be developed following a comprehensive exercise in which the risks and hazards in the community are compared to the likelihood of their occurrence.